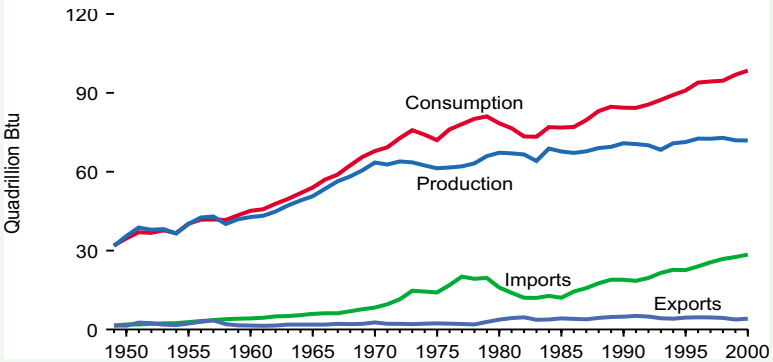
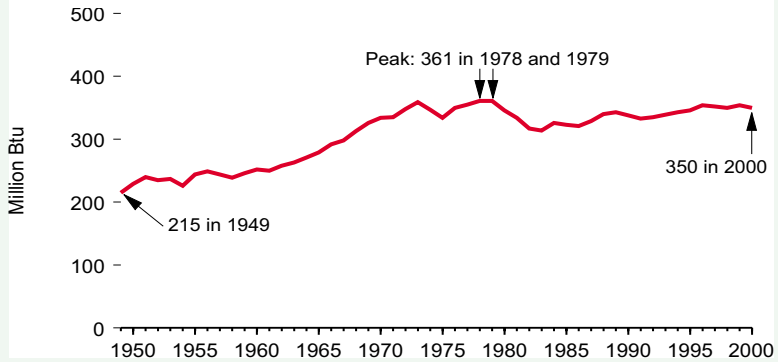
Overview

Figure 1. Energy Overview



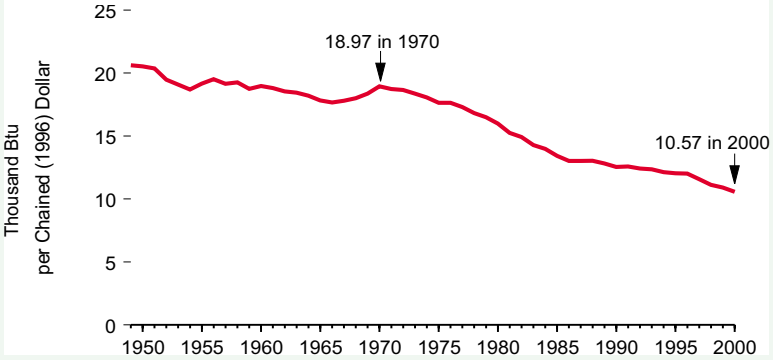
The United States was self-sufficient in energy until the late 1950s when energy consumption began to outpace domestic production. From 1970 to 2000, U.S. energy consumption grew 45 percent while production rose 13 percent. The Nation imported more energy to fill the gap.

Figure 2. Energy Consumption per Person



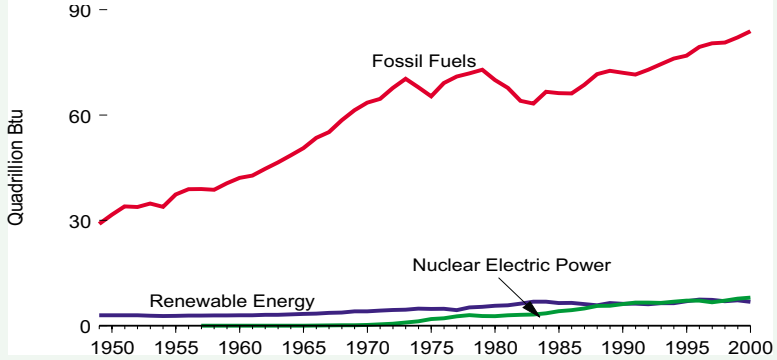
Energy use per person stood at 215 million Btu in 1949. The rate generally increased until the oil price shocks of the mid-1970s and early 1980s caused the pattern to reverse for a few years. The trend in the 1990s was upward again, reaching 350 million Btu per person in 2000.

Figure 3. Energy Use per Dollar of Gross Domestic Product



Over the second half of the 20th century, the rate at which energy was consumed per dollar of the economy's output of goods and services fell dramatically. By the end of the century, the rate was half of the mid-century level. The rate in 2000 was 44 percent below that in 1970.

Figure 4. Energy Consumption by Source



Most energy consumed in the United States has come from fossil fuels. Renewable energy resources have supplied a relatively small but steady portion. In the late 1950s, nuclear fuel began to be used to generate electricity, and, by the late 1980s, contributed about the same share as renewable energy.

Consumption by Source

Figure 5. Energy Consumption by Source, 1635-2000

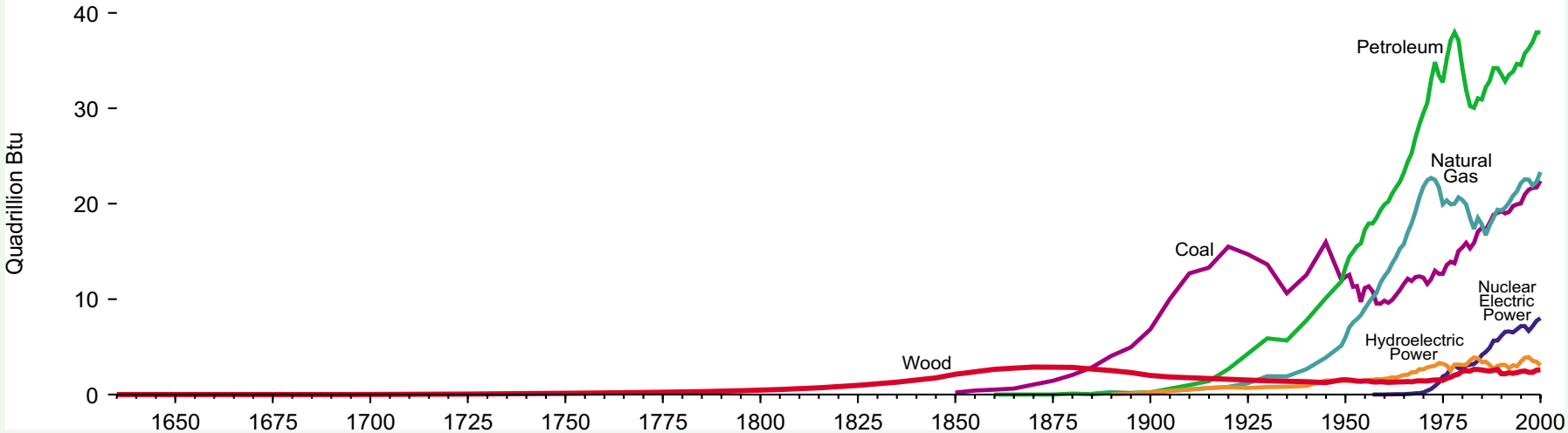
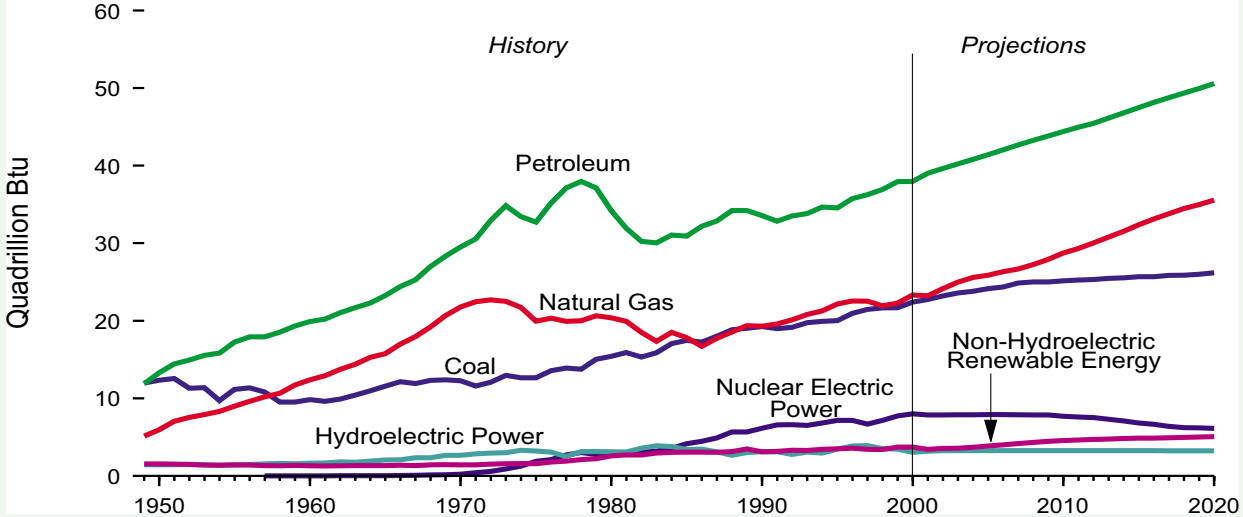


Figure 6. Energy Consumption History and Outlook, 1949-2020

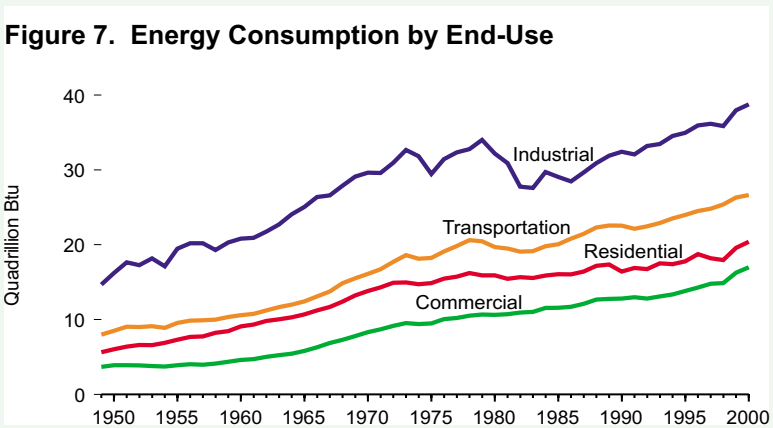


In the long view of American history, wood served as the preeminent form of energy for about half of the Nation's history. Around 1885, coal surpassed wood's usage. Despite its tremendous and rapid expansion, coal was, in turn, overtaken by petroleum in the middle of the 20th century. Natural gas, too, experienced rapid development into the second half of the 20th century, and coal began to expand again. Late in the 20th century still another form of energy, nuclear electric power, was developed and made significant contributions.

While the Nation's energy history is one of large-scale change as new forms of energy were developed, the outlook for the next couple of decades (assuming current laws, regulations, and policies) is for continued growth and reliance on the three major fossil fuels—petroleum, natural gas, and coal—and for dwindling use of nuclear electric power and modest expansion in renewable resources.

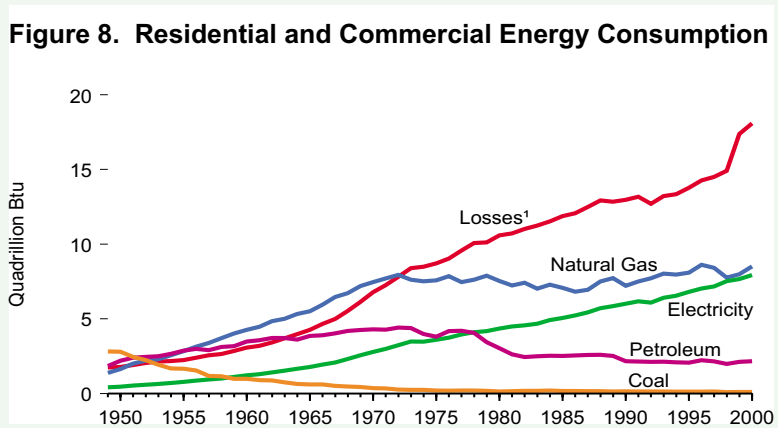
Consumption by Sector

Figure 7. Energy Consumption by End-Use



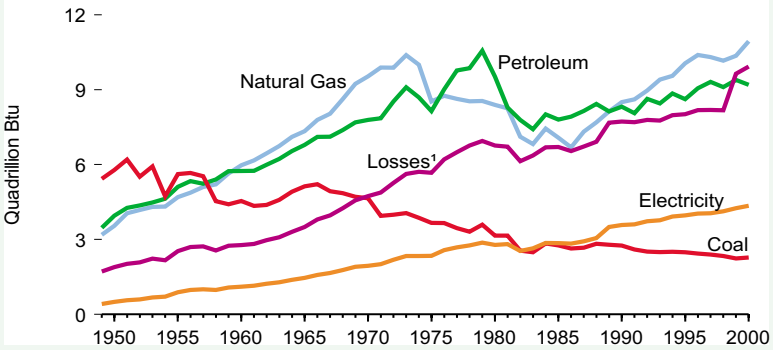
The industrial sector of the economy used the largest share of energy and showed the greatest volatility. In particular, steep drops occurred in 1975 and 1980-83 in response to high oil prices. Transportation was the next largest energy consuming sector, followed by residential use and commercial use.

Figure 8. Residential and Commercial Energy Consumption



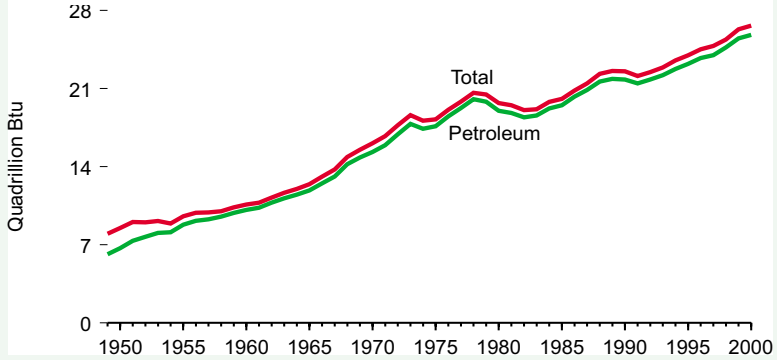
Coal, once important to residential and commercial consumers, was gradually replaced by other forms of energy. Petroleum use peaked in the early 1970s. Natural gas grew fast until the early 1970s and then fluctuated around the 1970 level over the next three decades. Meanwhile, electricity's use expanded dramatically.

Figure 9. Industrial Energy Consumption



Coal, once the prominent form of energy in the industrial sector, gave way to natural gas and petroleum in the late 1950s. Both natural gas and petroleum expanded rapidly until the early 1970s; after that, large swings occurred. The use of electricity grew tenfold over five decades.

Figure 10. Transportation Energy Consumption

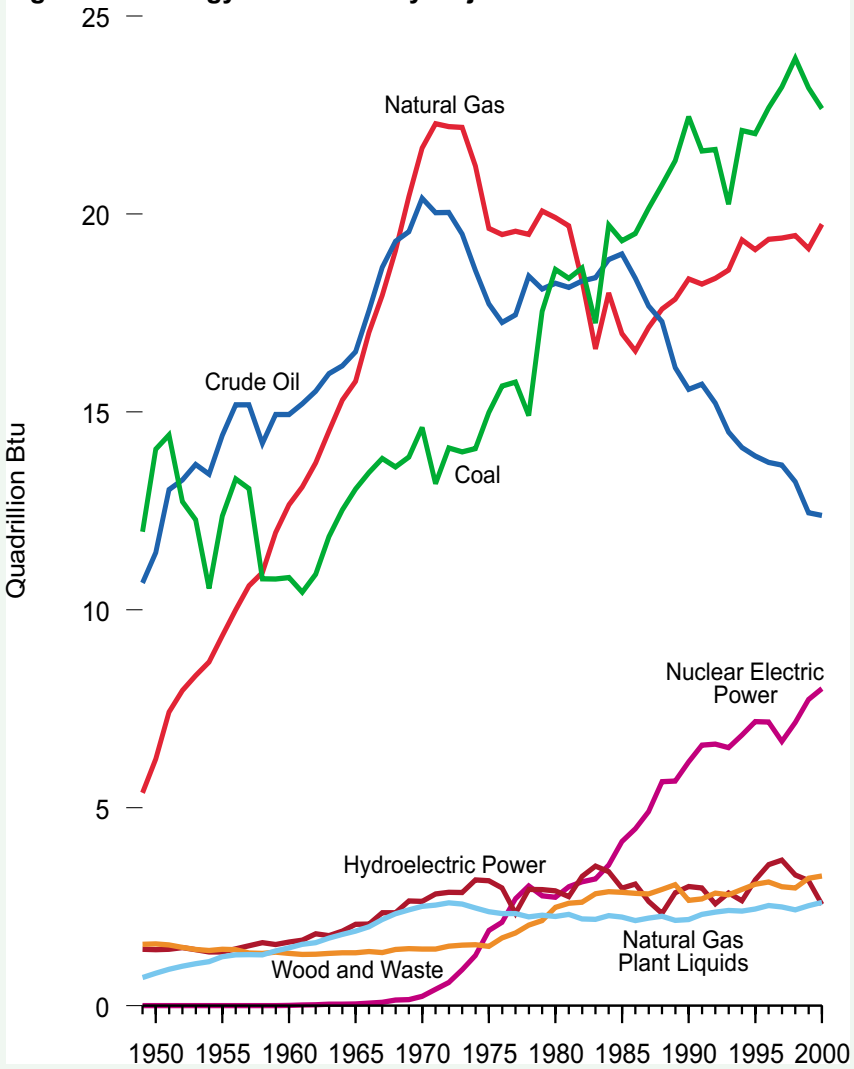


The transportation sector's use of energy, which is overwhelmingly petroleum, more than tripled from 1949 to 2000. Motor gasoline accounts for about two-thirds of the petroleum consumed in the sector. Distillate fuel oil and jet fuel are other important petroleum products used in the sector.

[1] Energy lost during generation, transmission, and distribution of electricity. See Tables 2.1b-2.1d, footnote 7, about a data discontinuity between 1998 and 1999.

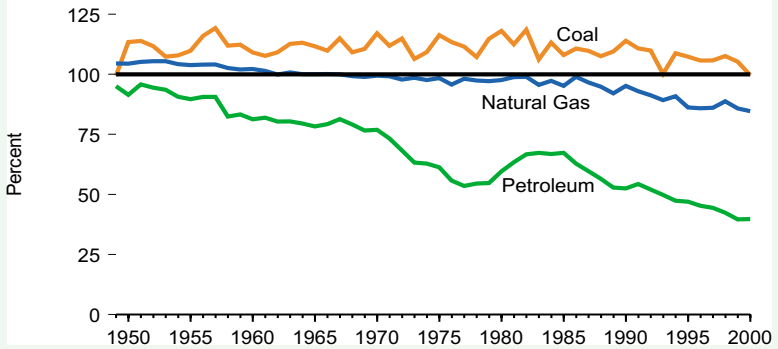
Production and Trade

Figure 11. Energy Production by Major Source



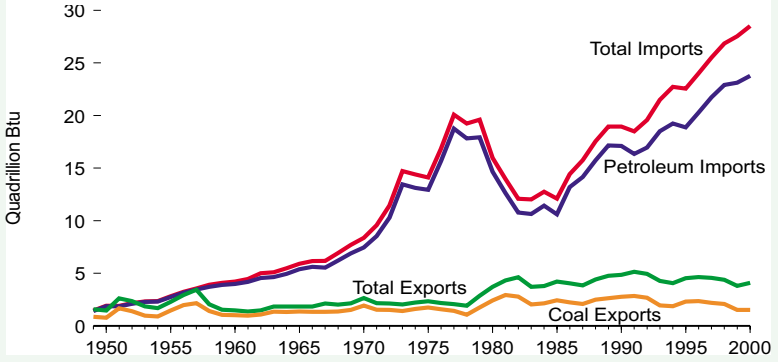
Most energy produced in the United States comes from fossil fuels—coal, natural gas, and crude oil. Coal, the leading source at the middle of the 20th century, was surpassed by crude oil and natural gas for many years, but again became the leading source of energy in the mid-1980s.

Figure 12. Fossil Fuel Production as Share of Consumption



The Nation almost always produced more than enough coal for our own requirements. For many years, we were self-sufficient in natural gas, too, but after 1967, we produced less than we consumed each year. Petroleum production fell far short of domestic requirements.

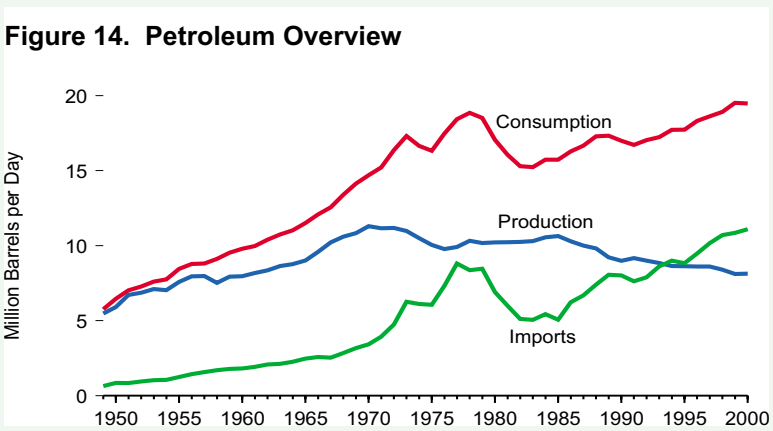
Figure 13. Energy Imports and Exports



When domestically produced energy could not meet demand, imports filled the gap. In 2000, net imported energy supplied one-quarter of all U.S. energy consumed, mostly in the form of petroleum. When the Nation had excess energy, it was often exported to buyers in other countries. U.S. energy exports were mostly coal.

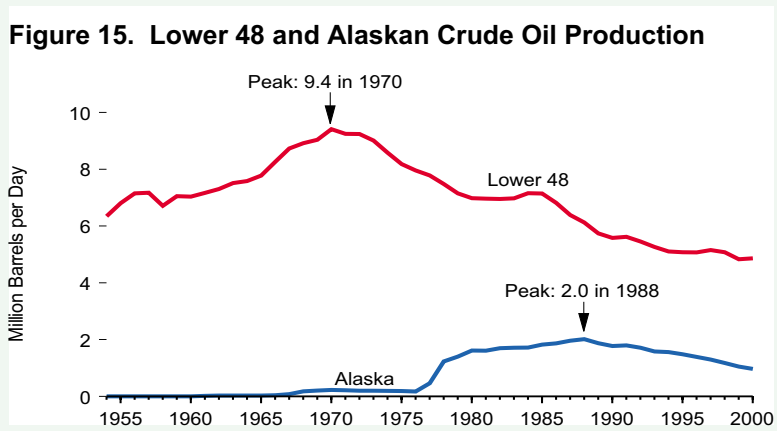
Crude Oil Production

Figure 14. Petroleum Overview



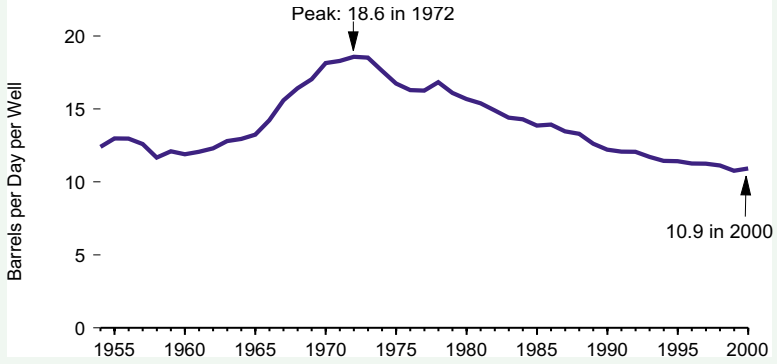
U.S. production of crude oil and natural gas plant liquids peaked in 1970 at 11.3 million barrels per day. By 2000, production was down to 8.1 million barrels per day. While domestic production fell, consumption continued to expand. Beginning in 1994, the Nation imported more petroleum than it produced.

Figure 15. Lower 48 and Alaskan Crude Oil Production



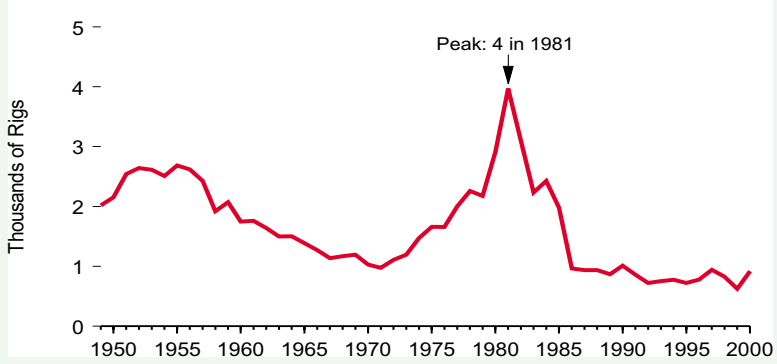
Crude oil production peaked in the U.S. lower 48 States at 9.4 million barrels per day in 1970. As lower 48 production fell, Alaska's production came on line and helped supply U.S. needs. Alaskan production peaked at 2.0 million barrels per day in 1988 and fell to less than half the peak rate by 2000.

Figure 16. Oil Well Productivity



The amount of crude oil produced per day per well rose sharply in the 1960s, reached a peak of 18.6 barrels per day per well in 1972, and, except for a brief recovery in 1978, fell steadily in the following years. By 2000, productivity measured 10.9 million barrels per day per well, 41 percent below the peak.

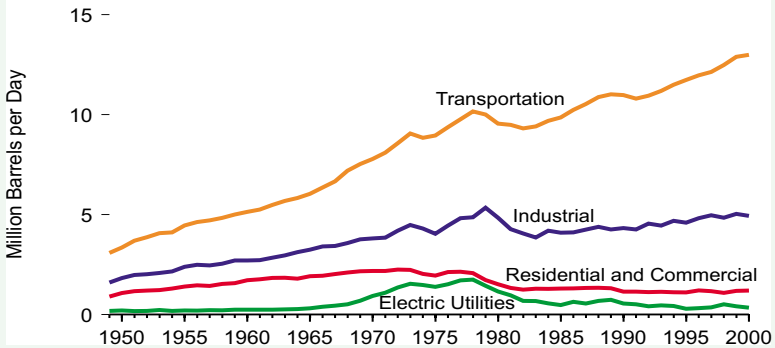
Figure 17. Rotary Rigs in Operation



Rotary rig activity declined sharply in the period from 1955 to 1971. After 1971, the number of rigs in operation began to climb again, and a peak of 4 thousand rigs in operation was registered in 1981. A sharp decline occurred after the peak, and rigs in operation in 2000 stood at 918, 77 percent below the peak.

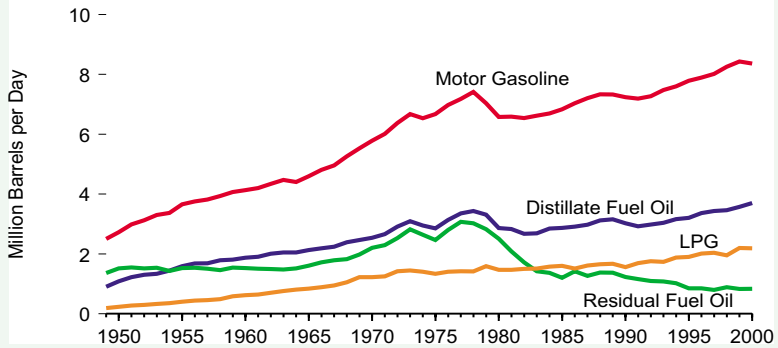
Petroleum Consumption and Prices

Figure 18. Petroleum Consumption by Sector



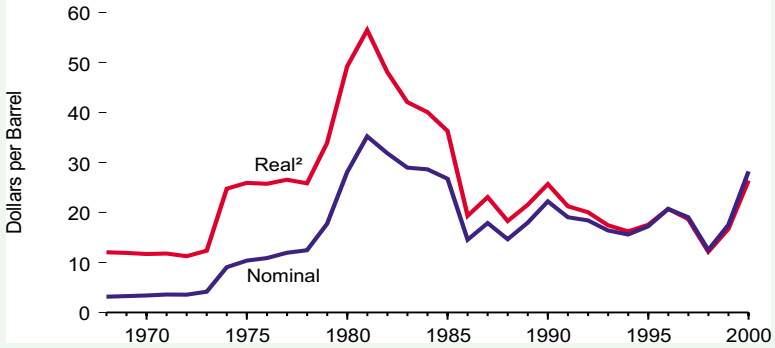
Transportation was the largest consuming sector of petroleum and the one showing the greatest expansion over the second half of the 20th century. In 2000, 13 million barrels per day of petroleum products were consumed for transportation purposes, accounting for 67 percent of all petroleum used.

Figure 19. Petroleum Consumption by Selected Product



Motor gasoline is the single largest petroleum product consumed in the United States. Its consumption stood at 8.4 million barrels per day in 2000, 43 percent of all petroleum consumption. Distillate fuel oil and liquefied petroleum gases (LPG) are other important products. The use of residual fuel oil fell off sharply after 1977.

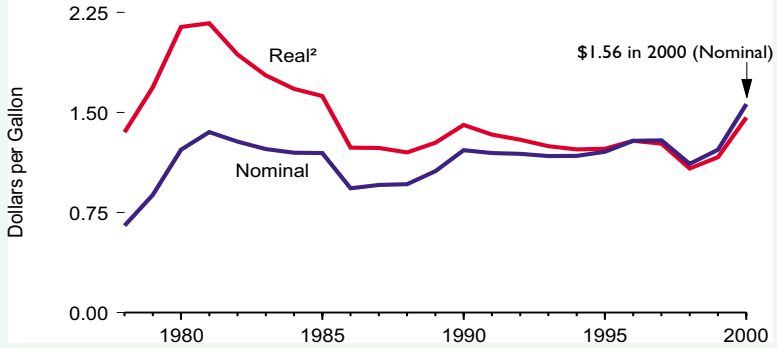
Figure 20. Crude Oil Refiner Acquisition Cost[1]



The refiner acquisition composite (domestic and foreign) cost of crude oil in nominal (unadjusted for inflation) dollars peaked at $35 per barrel in 1981. The price fell dramatically over the years that followed, then rose from $18 per barrel in 1999 to $28 per barrel in 2000. Adjusted for inflation, the 2000 price was 53 percent below the peak.

[1] Composite of domestic and imported crude oil.

Figure 21. Price of Motor Gasoline

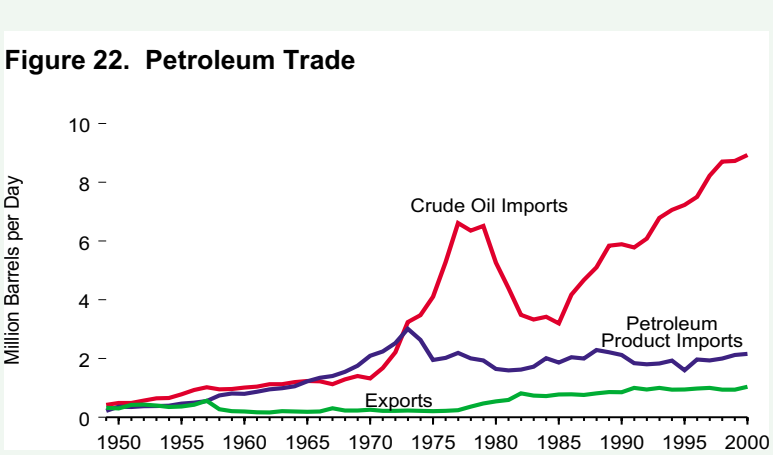


In nominal (unadjusted for inflation) dollars, Americans paid an average of 65¢ per gallon for motor gasoline in 1978. The 2000 average price of $1.56 was 140 percent higher than the 1978 rate but, adjusted for inflation, it was only 8 percent higher.

[2] In chained (1996) dollars, calculated by using gross domestic product implicit price deflator.

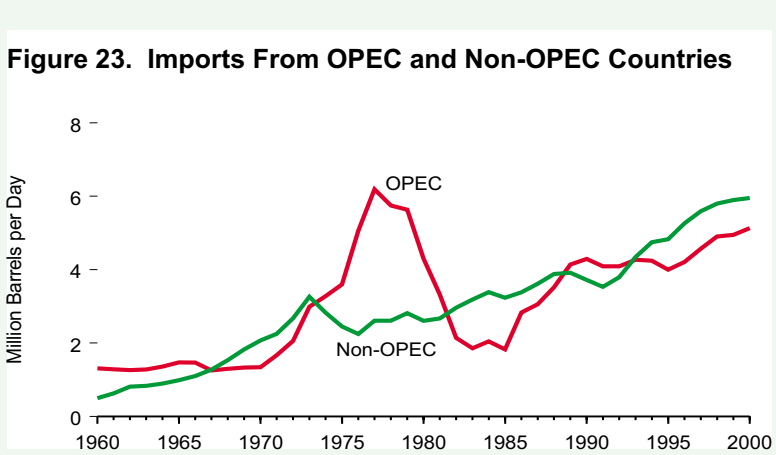
Petroleum Trade

Figure 22. Petroleum Trade



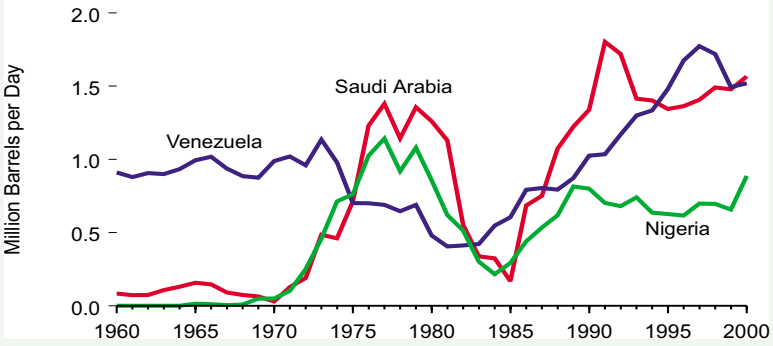
U.S. imports of crude oil rose dramatically from mid-century until the late 1970s, fell sharply until 1985, and then resumed a trend of rapid increases. In 2000, a record-high level of 9 million barrels per day of imported crude oil was registered, and imports of petroleum products stood at 2 million barrels per day.

Figure 23. Imports From OPEC and Non-OPEC Countries



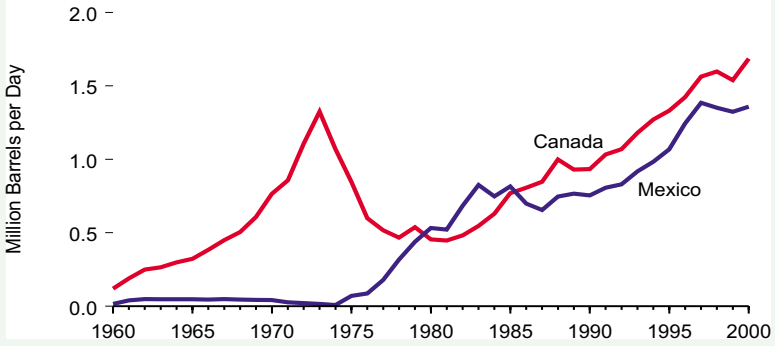
As U.S. petroleum imports rose sharply in the late 1970s, the Nation's reliance on petroleum from the Organization of Petroleum Exporting Countries (OPEC) grew. In 1977, 70 percent of U.S. petroleum imports came from OPEC countries. After 1992, most petroleum imports came from non-OPEC countries.

Figure 24. Imports From Selected OPEC Countries



Among OPEC countries, Saudi Arabia, Venezuela, and Nigeria—nations from three different continents—were key suppliers of petroleum to the American market. Even as our leading suppliers, those countries experienced tremendous fluctuation in the amount of petroleum sold to the United States over the decades.

Figure 25. Imports From Canada and Mexico

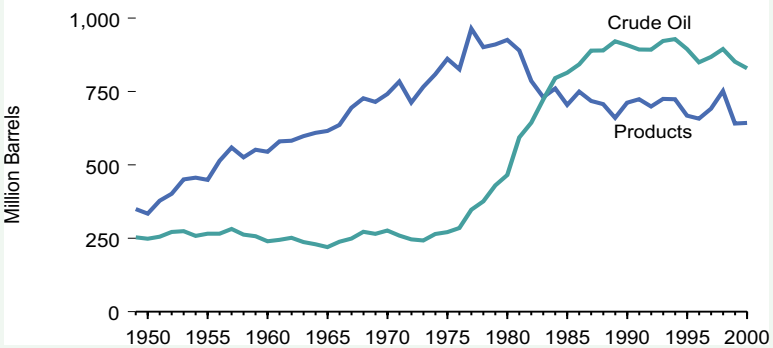


Canada and Mexico, our national neighbors, supplied the largest quantities of petroleum from non-OPEC countries. Imports from Mexico were insignificant until the mid-1970s when they began to play a key role in U.S. supplies. In 2000, Canada and Mexico together provided over one-fourth of all U.S. petroleum imports.

OPEC = Organization of Petroleum Exporting Countries.

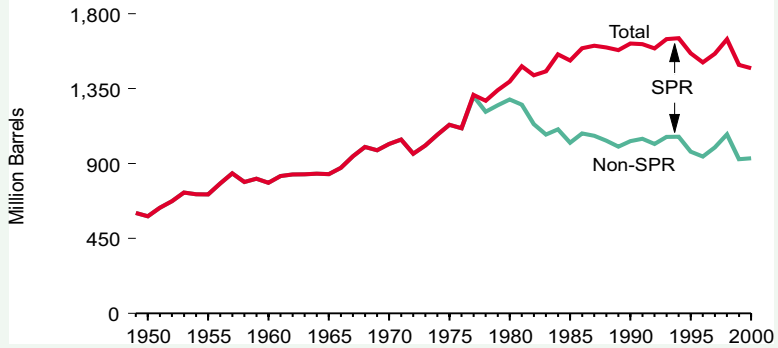
Petroleum Stocks

Figure 26. Stocks of Crude Oil and Products



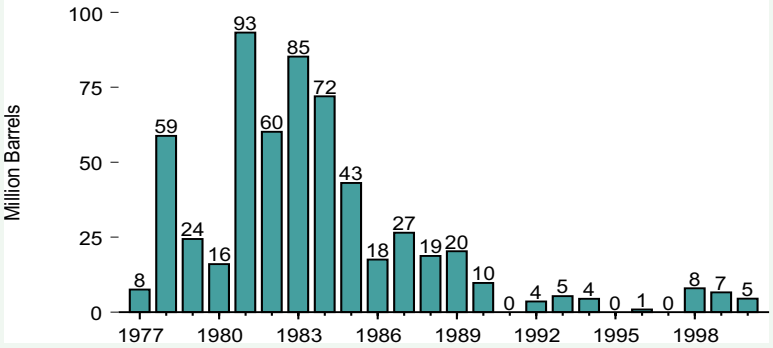
Through 1983, the Nation held most of its petroleum storage in the form of products, which are ready for the market. After that, most petroleum in storage was in the form of crude oil. At the end of 2000, petroleum stocks totaled 1.5 billion barrels, 56 percent crude oil and 44 percent products.

Figure 27. Strategic Petroleum Reserve (SPR) Stocks



In 1977, the United States began building a national reserve of petroleum stocks in case of emergency. The amount of crude oil held in the Strategic Petroleum Reserve (SPR) peaked at 592 million barrels in 1994 and 1995. The level at the end of 2000 was 541 million barrels. As SPR stocks were built, non-SPR stocks were reduced.

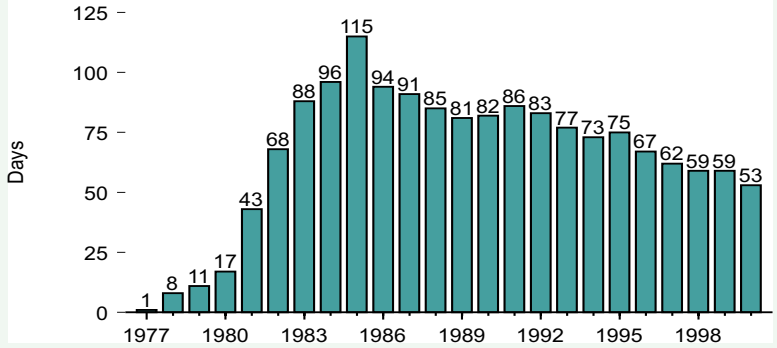
Figure 28. Crude Oil Imports for SPR[1]



Most of the crude oil in SPR is imported oil, and most of it came in during the early 1980s. In fact, from 1991 through 1997, only 14 million barrels were imported for the reserve, and in 3 of those years, no oil at all was imported for the reserve. In 2000, 4.5 million barrels of crude oil were imported for SPR.

[1]Imported by SPR and imported by others for SPR.

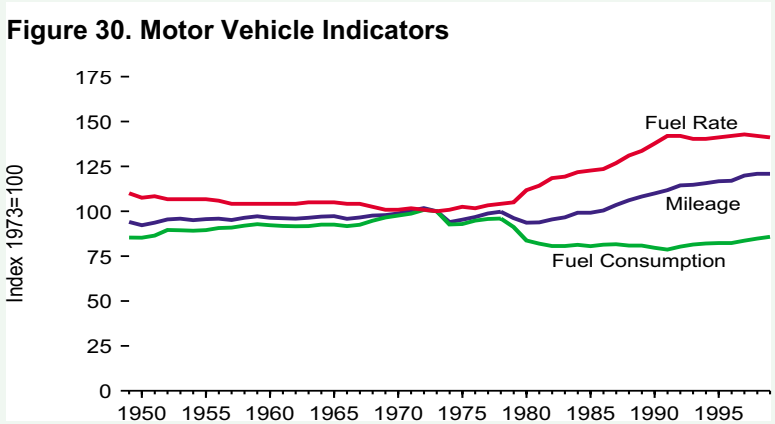
Figure 29. SPR Stocks as Days' Worth of Net Imports



An important SPR measure is the number of days' worth of total net imports of petroleum that could be met by the reserve in an emergency. The peak level occurred in 1985 when the reserve could have supplied 115 days of petroleum net imports, at the 1985 level. The rate trended down since then and stood at 53 days at the end of 2000.

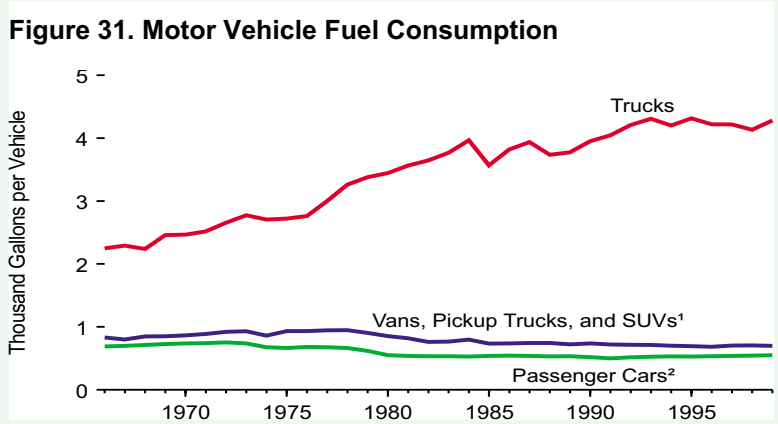
Motor Vehicles

Figure 30. Motor Vehicle Indicators



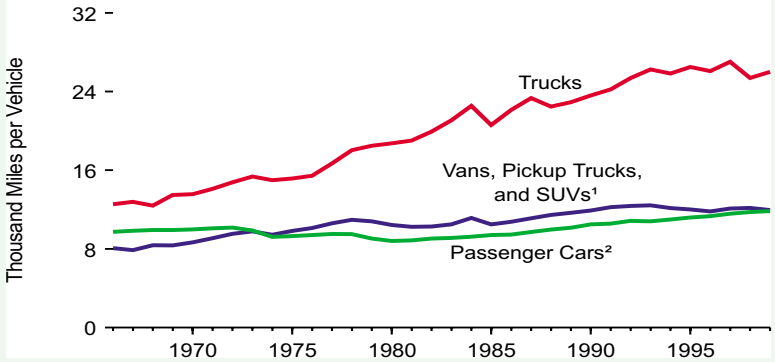
The composite motor vehicle fuel rate (miles per gallon) soared 42 percent from 1973 to 1991 but remained nearly flat over succeeding years. Miles driven per vehicle grew steadily from 1980 to 1998, but fell slightly in 1999. Fuel use per vehicle fell 21 percent from 1973 to 1991, but rebounded 9 percent by 1999.

Figure 31. Motor Vehicle Fuel Consumption



From 1966 to 1999, truck fuel consumption rates rose 90 percent from 2.3 thousand gallons per truck to 4.3 thousand gallons per truck. Fuel consumption rates of other vehicle types fell: passenger cars down 20 percent and other vehicles down 16 percent.

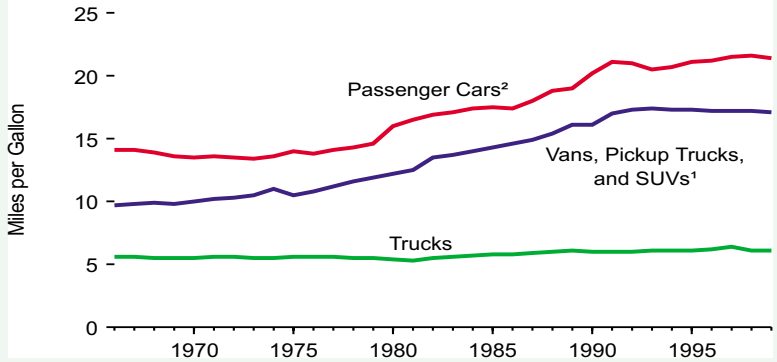
Figure 32. Motor Vehicle Mileage



Truck miles traveled per year exceeded that of other vehicle types and grew sharply from 1966 to 1999, up 108 percent. In 1999, trucks averaged 26 thousand miles per vehicle per year, while passenger cars, vans, pickup trucks, and sport utility vehicles averaged just under 12 thousand miles per year.

[1] Sport-utility vehicle.
[2] Motorcycles are included through 1989.

Figure 33. Motor Vehicle Fuel Rates

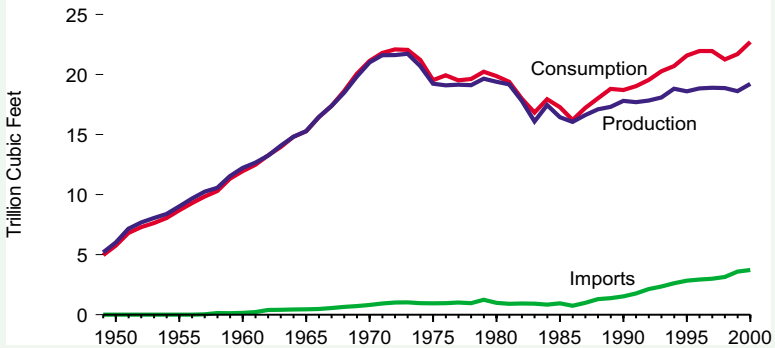


Since 1976, the average fuel rates (miles per gallon) of passenger cars and vans, pickup trucks, and sport utility vehicles trended upward, ending the 1990s with much better rates than they had a quarter century earlier. The truck fuel rate, however, showed little change.

Note: Motor vehicles include passenger cars, motorcycles, vans, pickup trucks, sport utility vehicles, trucks, and buses.

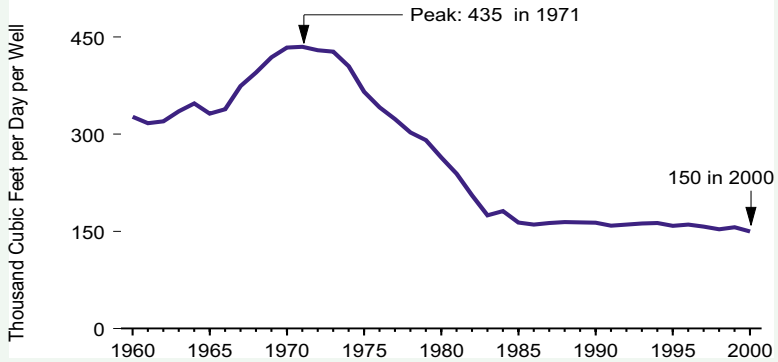
Natural Gas

Figure 34. Natural Gas Overview



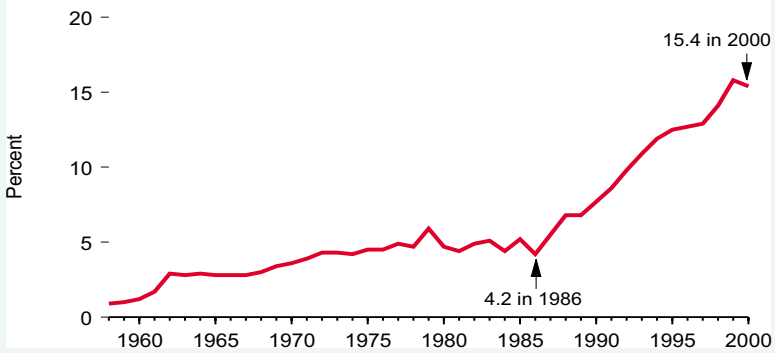
U.S. natural gas production and consumption were nearly in balance through 1986. When consumption began to outpace production, imports of natural gas rose to meet U.S. requirements for the fuel. In 2000, consumption stood at 22.7 trillion cubic feet (Tcf), production at 19.2 Tcf, and net imports at 3.5 Tcf.

Figure 35. Natural Gas Well Productivity



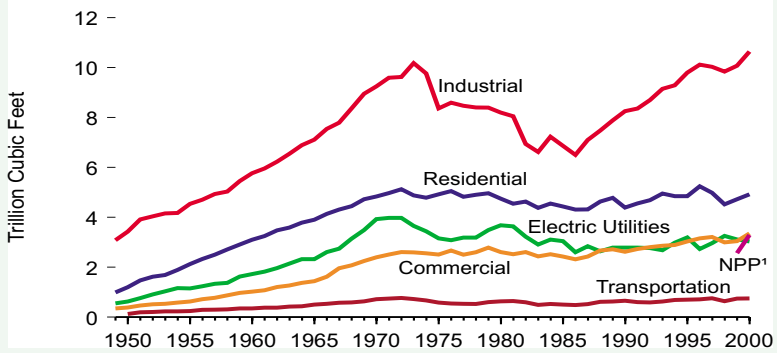
Gas well productivity, measured as gross withdrawals per day per well, grew rapidly in the late 1960s, peaked in 1971, and then fell sharply until the mid-1980s. Productivity remained nearly steady after 1985. The 2000 rate of 150 thousand cubic feet per day per well was 66 percent below the 1971 peak level.

Figure 36. Net Imports as Share of Consumption



Net imports as a share of consumption registered in the 4-to-5 percent range in the 1970s and early 1980s. Net imports measured 4.2 percent of consumption in 1986, which was followed by consumption increases that outpaced production growth. Net imports expanded, and in 2000 accounted for 15.4 percent of consumption.

Figure 37. Natural Gas Consumption by Sector

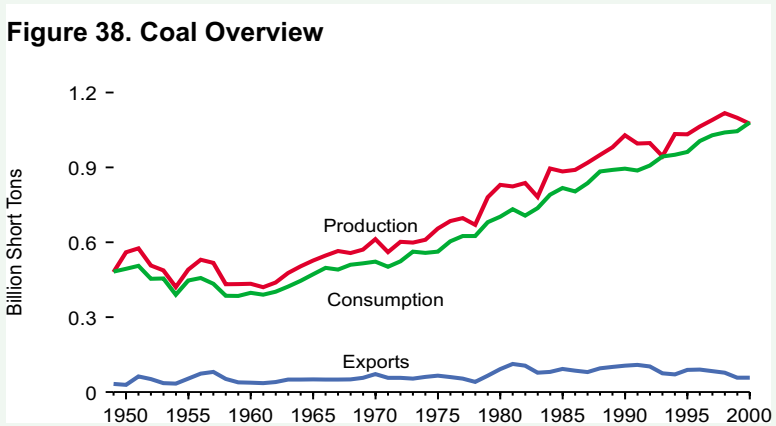


[1]Nonutility power producers; data available for 1999 and 2000 only.

The industrial sector was both the largest consuming sector of natural gas and the sector with the greatest volatility over the years. The electric power sector (electric utilities and nonutility power producers) accounted for over one-fourth of all natural gas consumption in 2000.

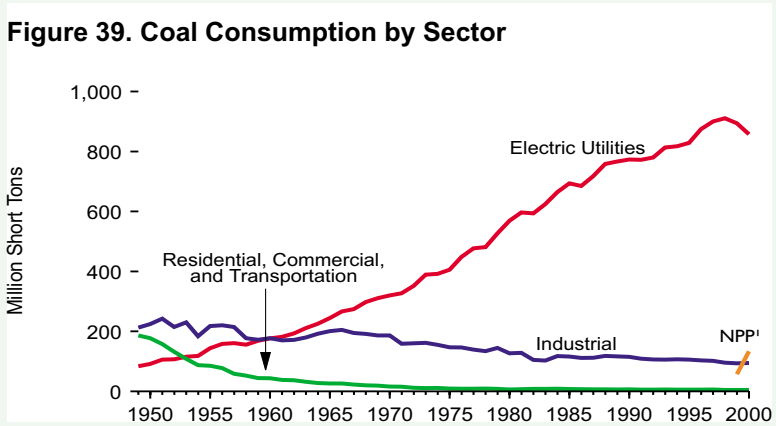
Coal

Figure 38. Coal Overview



Unlike petroleum or natural gas, domestic supplies of coal nearly always outpaced U.S. consumption of the resource. Excess production of coal was available for export to other countries. About one-third of U.S. exported coal went to Canada.

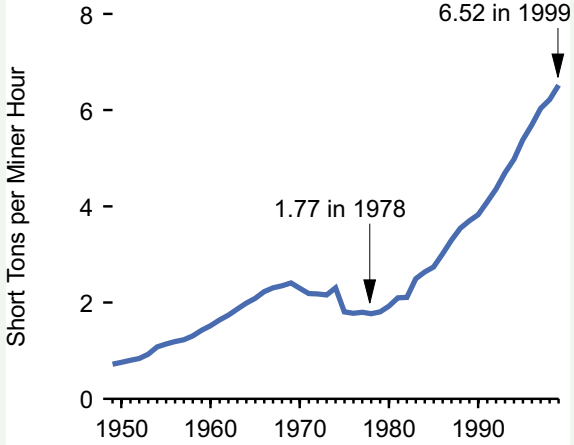
Figure 39. Coal Consumption by Sector



[1]Nonutility power producers; data available for 1999 and 2000 only.

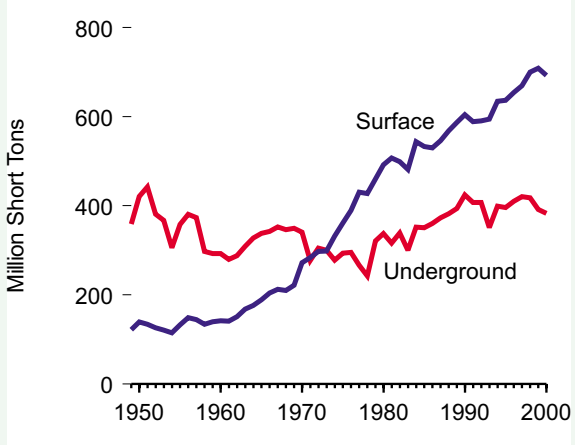
In the 1950s, most coal was consumed in the industrial sector, many homes were still heated by coal, and the transportation sector consumed coal in steam-driven trains and ships. By the 1960s, most coal was used for generating electricity and by 2000 electricity's share stood at 92 percent of all coal consumption.

Figure 40. Coal Mining Productivity



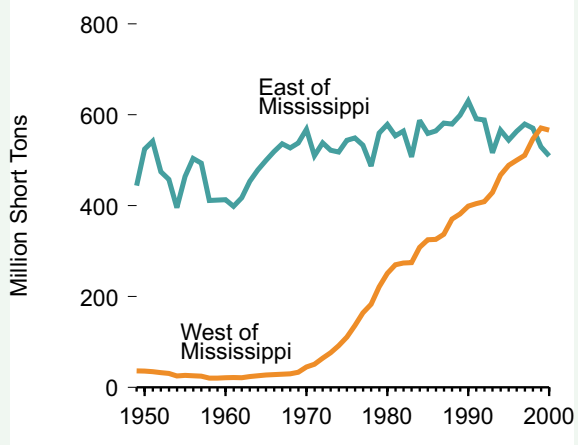
Improved mining technology and the shift toward more surface-mined coal promoted increased productivity from the Nation's mines after 1978.

Figure 41. Production by Mining Method



Most growth of coal production came from surface mines, which surpassed underground production after 1973.

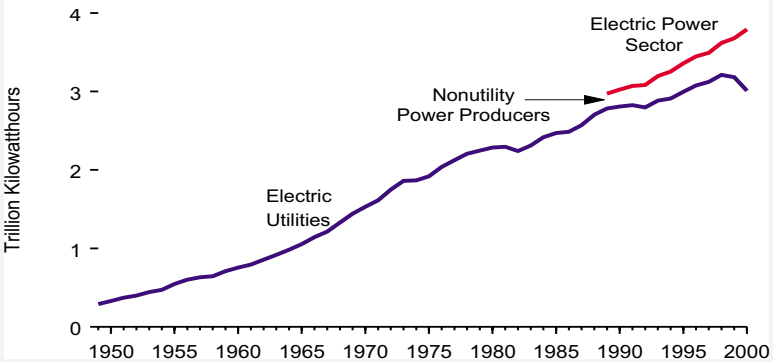
Figure 42. Production by Location



Western coal production expanded tremendously after 1969 and exceeded production from the East in 1999 and 2000.

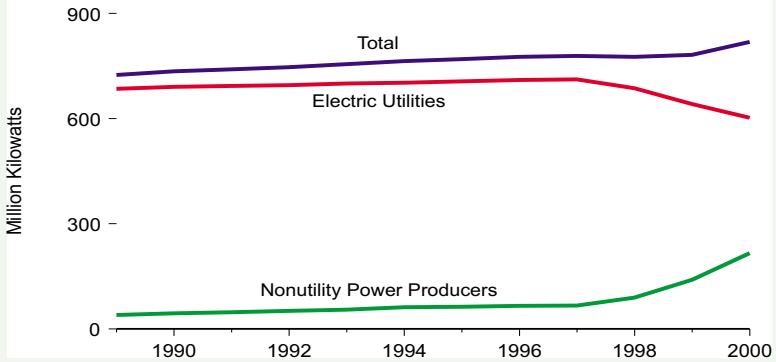
Electricity Generation

Figure 43. Electric Power Sector Net Generation



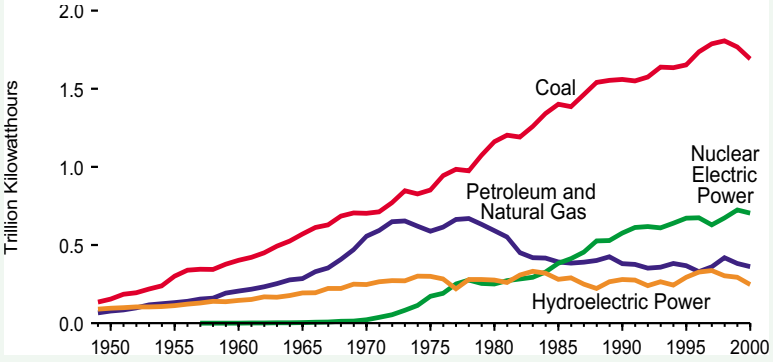
Electric power generation grew from 0.3 trillion kilowatthours in 1949 to 3.8 trillion kilowatthours in 2000. Over the entire span, electricity failed to increase in only one year, 1982, when a 2-percent decrease was recorded.

Figure 44. Electric Power Sector Net Summer Capability



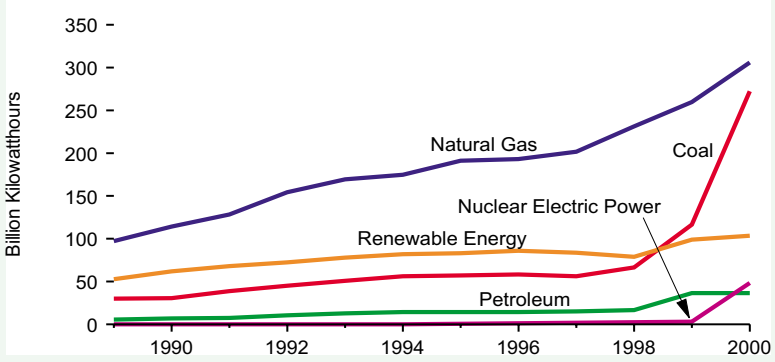
Since 1949, total capability fell in only one year, 1998, when a 0.3-percent decrease was recorded. In recent years, industry deregulation caused capacity to shift from utilities to nonutility power producers, but in 2000 about 74 percent of capacity was still owned by utilities.

Figure 45. Electric Utilities Net Generation



Most utility generation came from coal. In fact, in 2000, fossil fuels (coal, petroleum, and natural gas) accounted for 68 percent of all net generation, while nuclear electric power contributed 23 percent, and renewable energy resources 8 percent. Most net generation from renewable energy resources was derived from hydroelectric power.

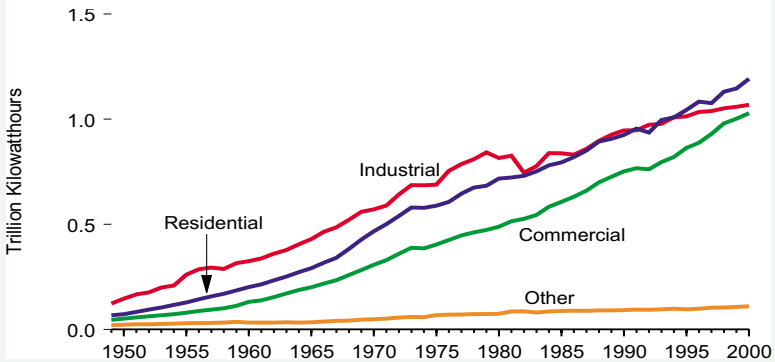
Figure 46. Nonutility Power Producers Net Generation



Nonutility power producer net generation expanded rapidly from 188 billion kilowatthours in 1989 to 782 billion kilowatthours in 2000. In 2000, fossil fuels accounted for 81 percent of all nonutility net generation; nuclear electric power 6 percent; and renewable energy resources 13 percent.

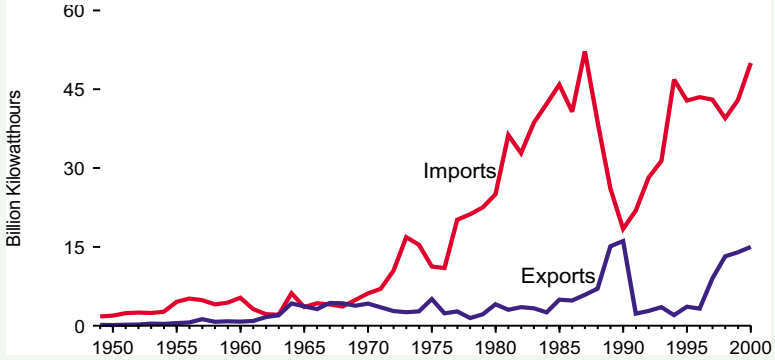
Electricity Sales, Prices, and Trade

Figure 47. Electric Utility Retail Sales by Sector



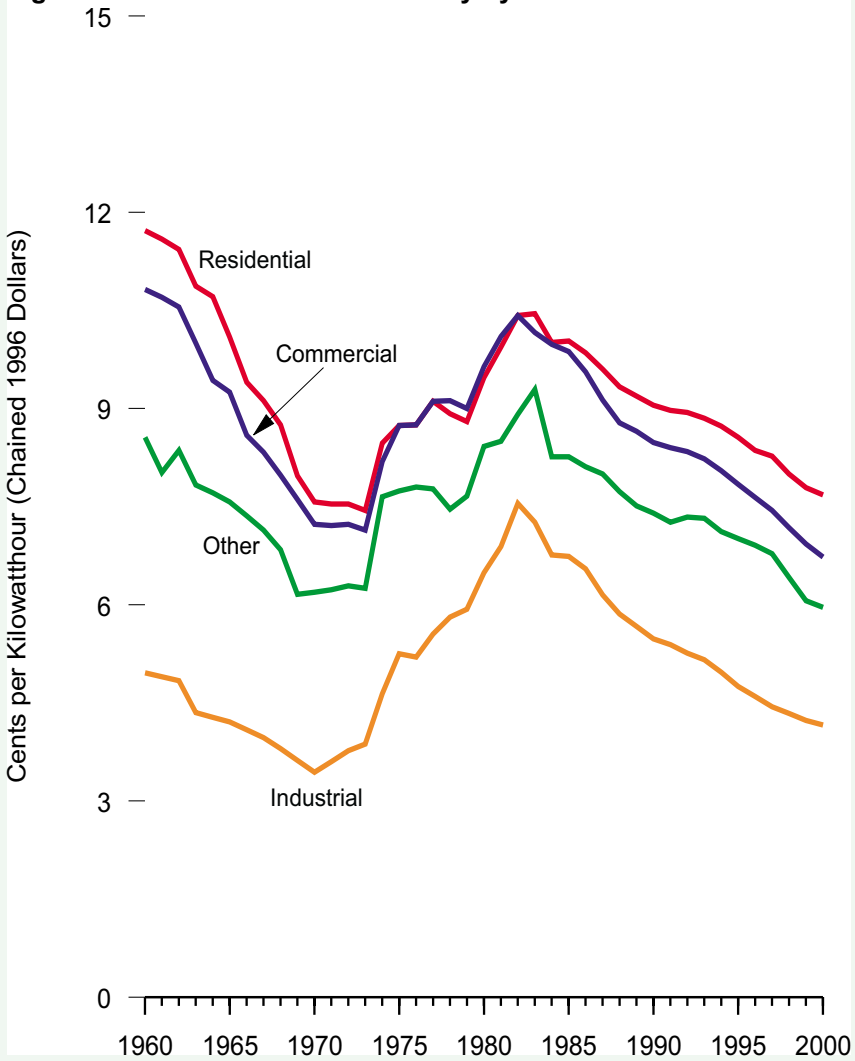
After mid-century, enormous growth occurred in energy sales in all three major sectors—residential, industrial, and commercial. Beginning in 1993, residential sales surpassed industrial sales. The industrial sector's use of electricity showed the greatest volatility, especially from the late 1970s through the mid 1980s.

Figure 49. Electricity Trade



Except for a few years in the 1960s when imported and exported electricity were nearly equal, the United States imported more electricity than it exported. In 2000, net imported electricity was less than 1 percent of all electricity used.

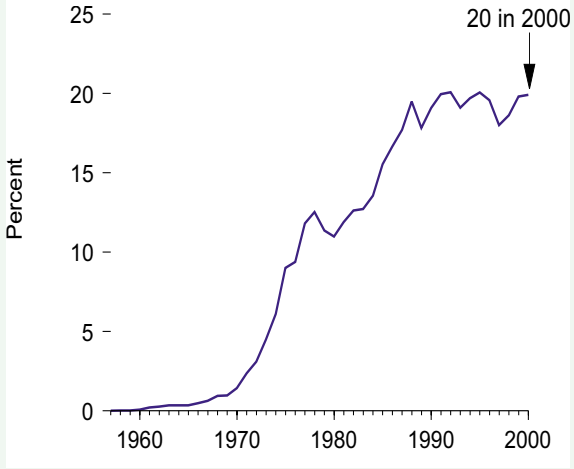
Figure 48. Retail Prices of Electricity by Sector



In inflation-adjusted terms, all sector prices for electricity fell steeply in the 1960s, reversed course around 1970 to rise sharply through the early 1980s, and then returned to a pattern of rapid decline. Over the decades, industrial consumers paid the lowest rates for electricity; residential customers usually paid the highest prices. In 2000, all sectors paid lower rates than they had in 1960.

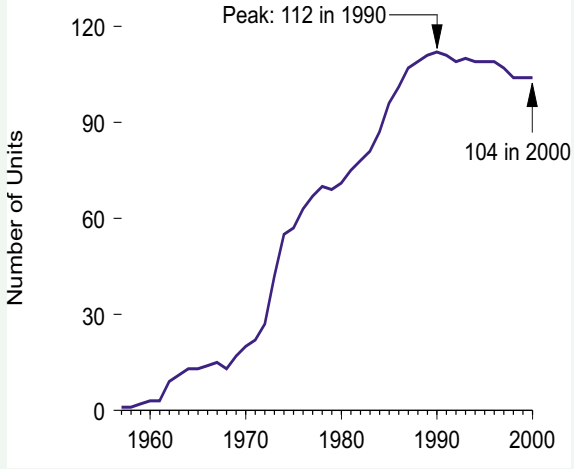
Nuclear Electric Power

Figure 50. Nuclear's Share of Electricity



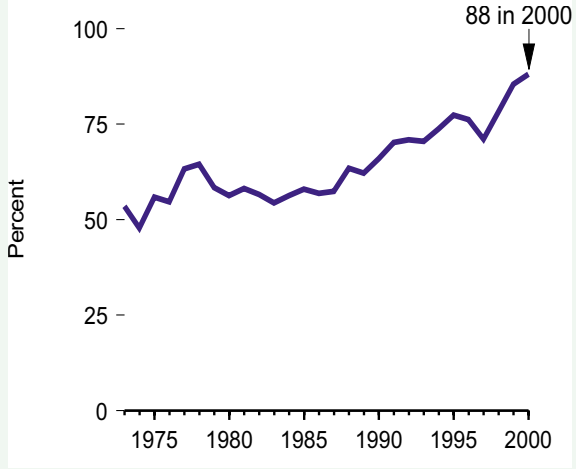
Nuclear-generated electricity came on line in the United States in 1957. Rapid development occurred in the 1970s and 1980s. In 2000, 20 percent of U.S. electricity came from nuclear power.

Figure 51. Number of Operable Units



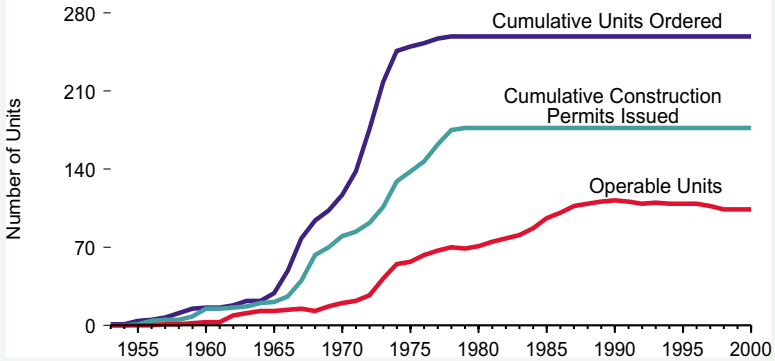
As the new industry developed, the number of operable nuclear units grew, peaking at 112 in 1990. Unit closures since then reduced the number of operable units to 104 by 2000.

Figure 52. Capacity Factors



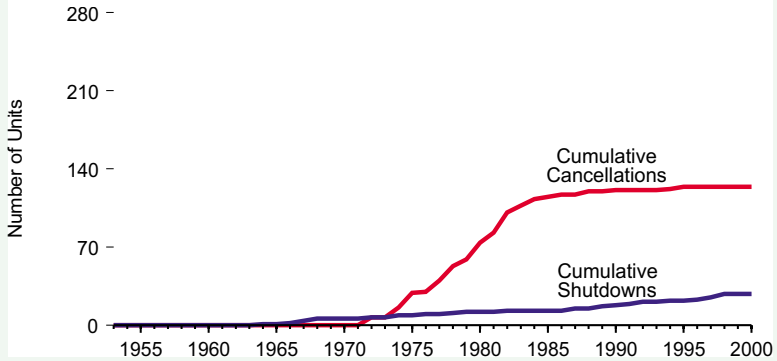
Capacity factors measure actual power generation as a share of maximum possible output. Factors for the industry were in the 50-to-60 percent range through the 1980s, but improved to 88 percent by 2000.

Figure 53. Nuclear Generating Unit Orders and Permits



Through 1978, 259 units were ordered in the United States; no more units were ordered after that date. Of the total ordered, 177 resulted in the issuance of a construction permit, but, ultimately, many fewer units were actually built. In 2000, there were 104 operable units.

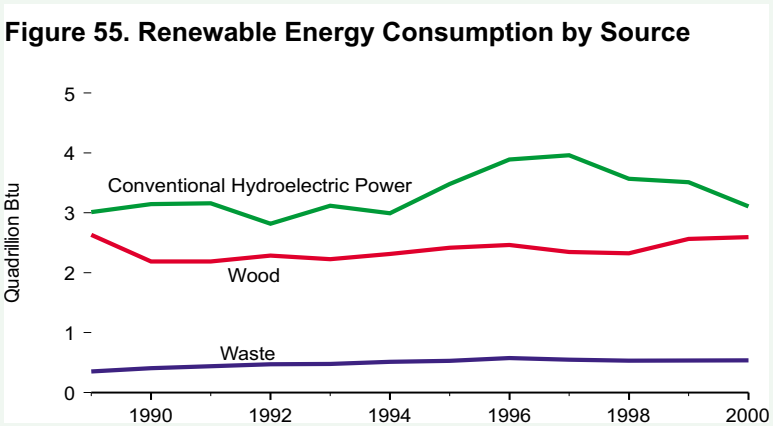
Figure 54. Unit Cancellations and Shutdowns



A cumulative total of 124 of the ordered units were cancelled and never built. Of those built, 28 were eventually shut down permanently. Three units still hold construction permits but are not expected to be built.

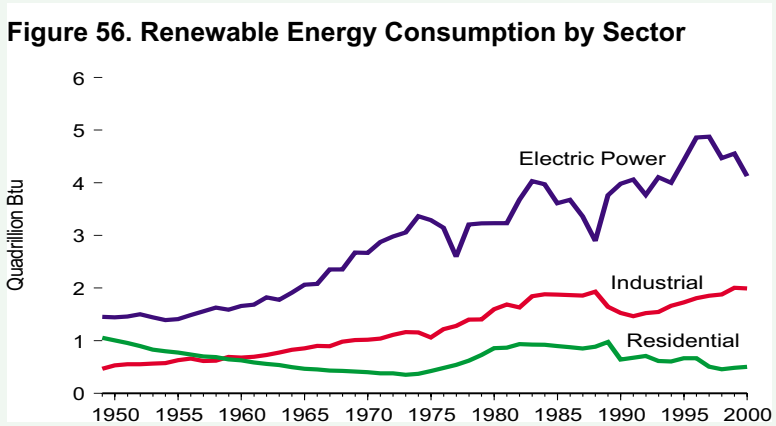
Renewable Energy

Figure 55. Renewable Energy Consumption by Source



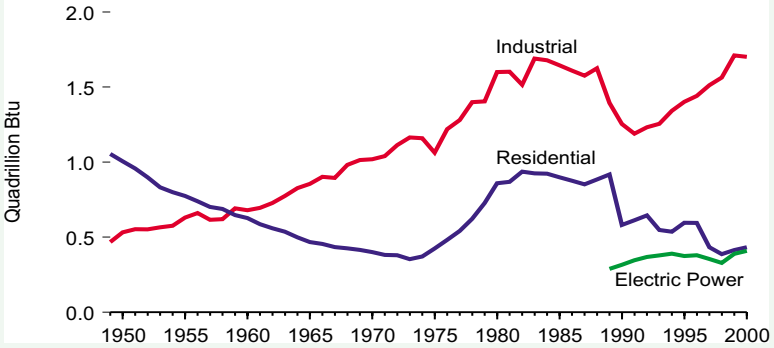
U.S. renewable energy consumption stood at about 7 quadrillion Btu per year from 1995 to 2000. Conventional hydroelectric power accounted for about half of all renewable energy. Wood was the next largest source of renewable energy, followed by waste and geothermal. Smaller quantities came from alcohol fuels, solar, and wind.

Figure 56. Renewable Energy Consumption by Sector



Most renewable energy was consumed by the electric power sector to generate electricity. After 1958, the industrial sector was the second largest consuming sector of renewable energy, mostly wood. Residential sector usage of renewable energy (also mostly wood) was the next largest consuming sector.

Figure 57. Wood Consumption by Selected Sector



Over the second half of the 20th century, residential use of wood generally declined while the industrial sector's use of wood expanded. Commercial use was very small. In the last decade nonutility power producers' wood consumption boosted the electric power sector's total.

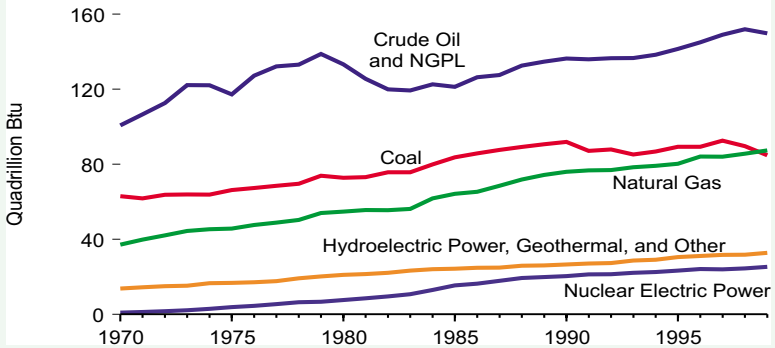
Figure 58. Solar Collector Shipments and Trade

Note: Data were not collected for 1985.

Solar collector total shipments peaked in 1981 at 21 million square feet. From 1991 through 1998, the level of shipments was 7 to 8 million square feet per year; shipments reached nearly 9 million square feet in 1999. Since 1983, imports of solar collectors exceeded exports, and the imports trend was generally increasing.

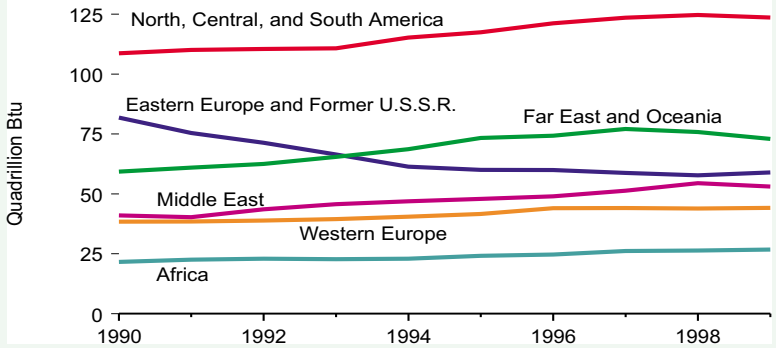
International Energy

Figure 59. World Primary Energy Production by Source



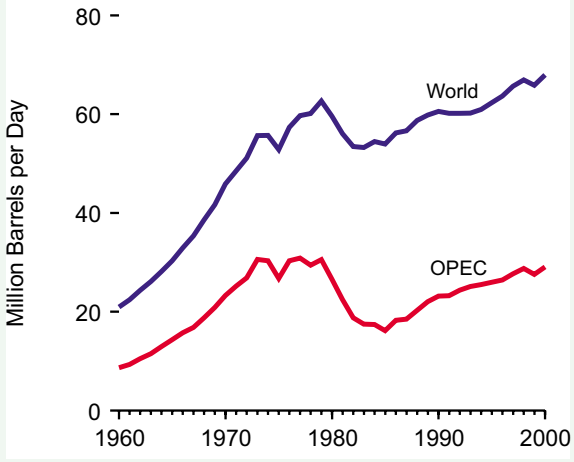
From 1970 to 1999, world primary energy production grew by 76 percent. Growth occurred in all types of energy. In 1999, fossil fuels accounted for 85 percent of all energy produced worldwide, renewable energy 9 percent, and nuclear power 7 percent.

Figure 60. World Primary Energy Production by Region



One-third of the 380 quadrillion Btu of energy produced worldwide in 1999 came from North, Central, and South America. Between 1990 and 1999, total primary energy production grew in all major regions of the world except Eastern Europe and the Former U.S.S.R., where production fell by 28 percent.

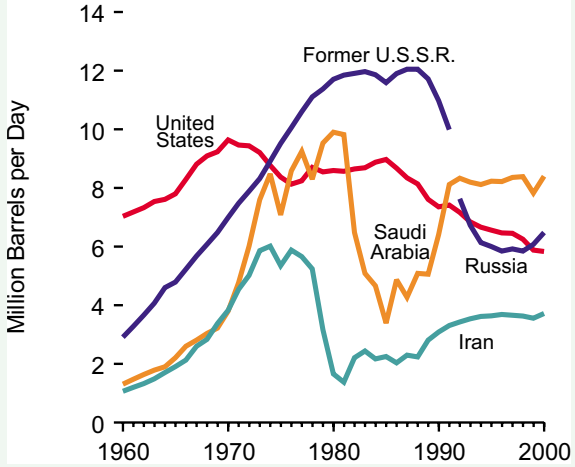
Figure 61. World Crude Oil Production



OPEC = Organization of Petroleum Exporting Countries.

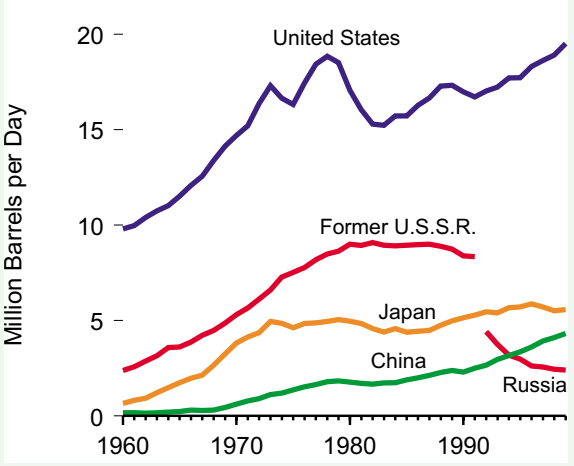
World crude oil production reached a record 68 million barrels per day in 2000. OPEC's share fell from 55 percent in 1973 to 43 percent in 2000.

Figure 62. Leading Crude Oil Producers



After 1991, Saudi Arabia was the largest producer. U.S. production peaked in 1970. Russia's production surpassed U.S. output in 1999 and 2000.

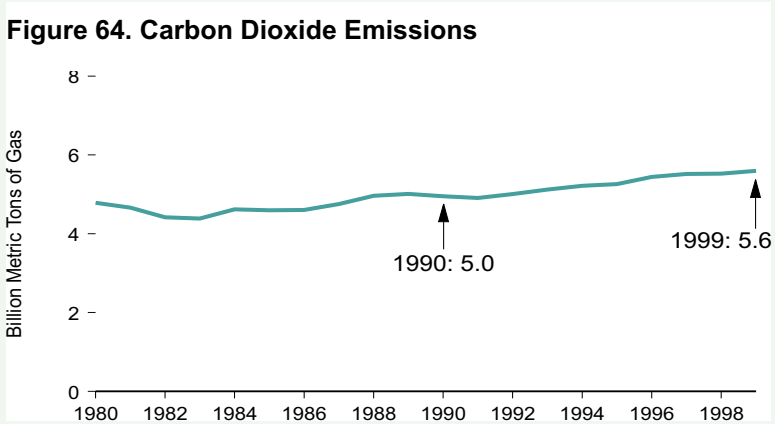
Figure 63. Leading Petroleum Consumers



The United States accounted for 26 percent of world consumption of petroleum in 1999. Japan and China accounted for 7 and 6 percent, respectively.

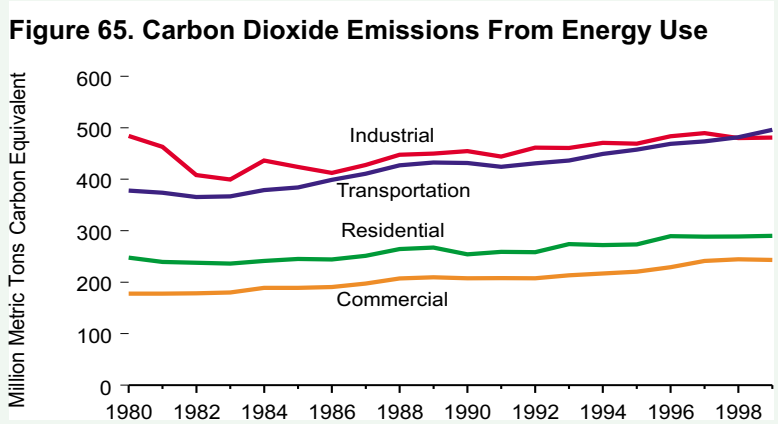
Carbon Dioxide Emissions

Figure 64. Carbon Dioxide Emissions



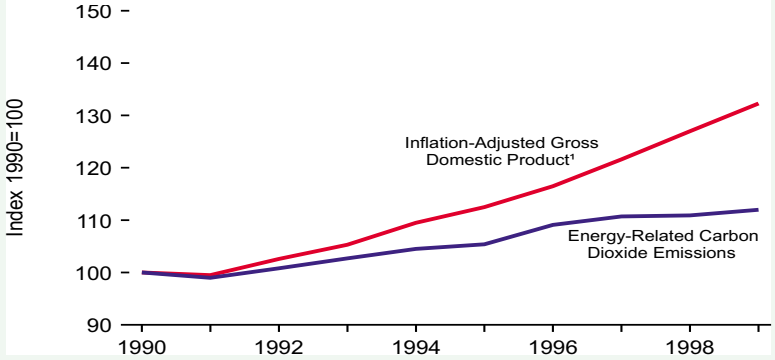
In the United States, fossil fuel combustion is responsible for 98 percent of all emissions from carbon dioxide, which is the most significant greenhouse gas. Total carbon dioxide emissions reached 5.6 billion metric tons of gas in 1999, 13 percent higher than the 1990 level.

Figure 65. Carbon Dioxide Emissions From Energy Use



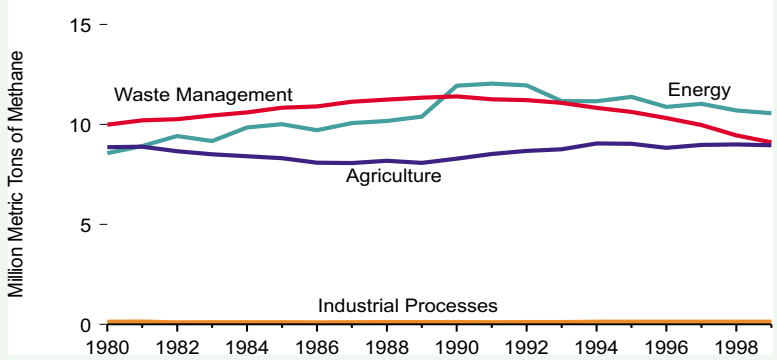
The level of carbon dioxide emissions generated by the industrial sector exceeded other sector levels until 1998 when it was surpassed by transportation emissions. Commercial sector emissions, the smallest of the four sectors, registered the largest percentage gain, 17, from 1990 to 1999.

Figure 66. GDP Growth and Carbon Dioxide Emissions



While gross domestic product (GDP) grew by 32 percent from 1990 to 1999, energy-related carbon dioxide emissions grew by 12 percent. It was primarily the use of less energy per unit of economic output, rather than the use of low-carbon fuels, that held the rate of carbon dioxide emissions growth below that of the inflation-adjusted gross domestic product.

Figure 67. Methane Emissions by Sector



In 2000, methane emissions accounted for 9 percent of total U.S. greenhouse gas emissions, weighted by global warming potential. Most methane emissions come from energy, waste management, and agricultural activities. The production, processing, and distribution of natural gas accounted for over half of all energy-related methane emissions in 2000.

[1] Based on chained (1996) dollars.

Figure Sources

Data for "Energy Perspectives" figures and text are derived from the following *Annual Energy Review 2000* tables and other sources as cited.

1. Table 1.1.
2. Table 1.5.
3. Table 1.5.
4. Table 1.3.
5. Tables F1a and F1b.
6. Historical data: Table 1.3; projections: Energy Information Administration (EIA), *Annual Energy Outlook 2001*, Table A1, National Energy Modeling System run AEO2001. D101600A.
7. Table 2.1a.
8. Tables 2.1b and 2.1c.
9. Table 2.1d.
10. Table 2.1e and 5.12c.
11. Table 1.2.
12. Tables 5.1, 6.1, and 7.1.
13. Table 1.4.
14. Table 5.1.
15. Table 5.2.
16. Table 5.2.
17. Table 4.3.
18. Tables 5.12a, 5.12b, 5.12c, and 5.12d.
19. Table 5.11.
20. Table 5.19.
21. Table 5.22.
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38. Tables 7.1 and 7.4.
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45. Table 8.3.
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55. Table 10.1.
56 Tables 10.2a and 10.2b.
57. Tables 10.2a and 10.2.b.
58. Table 10.3.
59. Table 11.2.
60. Table 11.1.
61. Table 11.4.
62. Table 11.4.
63. Table 11.9.
64. Table 12.1, and EIA, *Emissions of Greenhouse Gases in the United States 1999* (October 2000), page 13.
65. Table 12.2.
66. Tables 1.5 and 12.2, and EIA, *Emissions of Greenhouse Gases in the United States 1999* (October 2000), page 20.
67. Tables 12.1 and 12.4, and EIA, *Emissions of Greenhouse Gases in the United States 1999* (October 2000), Table 14.